Notes 1/31 - Order of Operations

P E | · M A + |
( ) 2* | ÷ D S − |

work left → right

Warnings + Hints:

1) Be sure to work Left to Right for Multiplication and division, and for add and subtract.

"subtraction and division are an illusion"

$6 - 4$ is also $6 + (-4)$

$8 \div 7$ is also $8 \cdot \frac{1}{7}$

$\frac{8}{7}$

Ex: $100 \div 5 \cdot 4$

Right:
$100 \div 5 \cdot 4$
$20 \cdot 4$
$= 80$

Wrong
$100 \div 5 \cdot 4$
$100 \div 20$
$= 5$

2) Square roots count as exponents
[because $\sqrt{9} = 9^{\frac{1}{2}}$, $\sqrt[3]{8} = 8^{\frac{1}{3}}$]

Ex: $5 + 2\sqrt{9}$
$5 + 2(3)$
$5 + 6 = 11$

3) Do the inner parentheses first ( ), [ ], { }

Ex: $\{5-[3^2+2-1](3)\}$

$\{5-[9+2-1](3)\}$

$\{5-10(3)\}$

$5-30 = -25$

4) Look carefully at the operations. Don't work too fast.

Ex: $\frac{5+6(3)}{23} = \frac{(5+18)}{23} = \frac{23}{23} = 1$

NOT $\frac{11(3)}{23}$ NOT $5+\frac{18}{23}$

Partner or Individual

Write your own order of operations problem

- Solve it correctly
- Solve it incorrectly
- Put both solutions on paper

Ex: $10 \div 5 \cdot 2$

Right ☺	Wrong ☹
$10 \div 5 \cdot 2$	$10 \div 5 \cdot 2$
$2 \cdot 2$	$10 \div 10$ ← oops! I didn't work L to R and multiplied first
4	$= 1$

Warm-Up 2/1

1) $\frac{1}{3}(3^2 + \sqrt{36})$

$\frac{1}{3}(9+6)$

$\frac{1}{3} \cdot \frac{(15)}{1} = \frac{15}{3} = 5$

2) $\frac{3(4) - 2(3)}{-2}$

$\frac{12-6}{-2} = \frac{6}{-2} = -3$

3) $(-2)^2 = (-2)(-2) = 4$

4) $-(2)^2 = -1 \cdot 2 \cdot 2 = -4$

5) $(6 + 14 \div 7 \cdot 2)^2$

$(6 + 2 \cdot 2)^2$

$(6+4)^2$

$(10)^2 = 100$

Notes 2/1 – Evaluating Expressions

To <u>evaluate</u>, replace the variable(s) with the value(s) given and then simplify using PEMDAS

Ex: evaluate if $r=-1$, $s=3$, $t=12$, $w=\frac{-1}{2}$, $v=0$

1) $6r + 2s$

$6(-1) + 2(3)$

$-6 + 6$

$\boxed{0}$

2) $s^2r - wt$

$(3)^2(-1) - (\frac{-1}{2})(12)$

$-9 + (+6)$

$\boxed{-3}$

Translating between verbal and Algebraic Expressions

2/1 - Notes Pt 2

Expression	vs.	Equation
no =		=
$3x^2 + 2$		$3x^2 + 2 = 5$
can't solve		solve for x

"Keywords:

Product	• multiply	
Sum	+	
Quotient	÷ , /	squared x^2
Difference	−	cubed x^3
"the quantity"	( )	

Ex: the sum of six times a number and 25

$6n + 25$ or $25 + 6n$

don't pick e, i, 0 $i = \sqrt{-1}$

four times the sum of a number and 3

$4(x+3)$ $x+3$ $4x+3$

* Be careful with "___ less than"

Ex: 4 less than a number squared

$-4 + r^2$ $r^2 - 4$ NOT $4 - r^2$

6) $3(11+x)$

7) $4s^2 + 5s$ $4(s^2+5s)$

9) 35 less than three times a number is 79

3 times a number decreased by 35 equals 79

Multiply by 9

Finger trick

9×6 → $6-1$ → 5 ; $9-5$ → 4

9×8 → $8-1$ → 7 ; $9-7$ → 2

Warm-Up 2/2

1) $5 + \frac{r}{6}$ or $5 + x \div 6$

2) $5x - 8$ or $-8 + 5x$

3) $8x$

4) $3x^2 + 4x$ Already simplified

5) $-2(5x - 1)$

$-10x + 2$

Notes 2/2 - Simplifying Expressions

"Like terms" - same variable(s) raised to the same power(s)

Like terms.

x, x^2, x^3 — □ ◻ — no

$2ab^2, -6ab^2$ — yes

$5x^2y, -1xy^2$ — $x \times y$, $x \times y \times y$ — no

* Be careful when subtracting a quantity
→ need to distribute the negative

Ex: $(3x^2y + 2x - 5) - 1(x^2y + 3x - 4)$

$3x^2y + 2x - 5 - x^2y - 3x + 4$

$2x^2y - x - 1$

$3x^2y + 2x - 5$
$-(x^2y + 3x - 4)$
$2x^2y - x - 1$

Ex 2: $8(3a - b) + 4(2b - a)$

$24a - 8b + 8b - 4a$

$20a$

$24a - 8b$
$+ -4a + 8b$

Notes Pt. 2 — Solving Equations

* When you solve an equation, work backwards through the order of operations to isolate the variable.

S A D M E P

Ex: $7x + 5 = 14$
$-5 \quad -5$

$\frac{7x}{7} = \frac{9}{7}$

$x = \frac{9}{7}$

* Consider simplifying each side first

Ex:

$$5a + 3 - 2a = a + 7$$

$$3a + 3 = a + 7$$

$-a \quad\quad -a$

get all variable to one side all #s to the other

$$2a + 3 = 7$$

$-3 \quad -3$

$$\frac{2a}{2} = \frac{4}{2}$$

$$\boxed{a = 2}$$

Warm-Up 213

1) $2(5a - 3b) - (2a + 4b)$

$10a - 6b - 2a - 4b$

$$\boxed{8a - 10b}$$

2) $-4x(2xy + 3)$

$-8x^2y - 12x$

3) $6p - 7 = 2$

$+7 \quad +7$

$$\frac{6p}{6} = \frac{9}{6}$$

$$\boxed{p = \frac{9}{6} = \frac{3}{2} = 1.5}$$

4) $4x + 3 = 2x - 1$

$-2x \quad -2x$

$2x + 3 = -1$

$-3 \quad -3$

$$\frac{2x}{2} = \frac{-4}{2}$$

$$\boxed{x = -2}$$

$4x + 3 = 2x - 1$

$+1 \quad +1$

$4x + 4 = 2x$

$4x + 4 = 0$

5) $\frac{4}{4}(2x - 1) = \frac{16}{4}$

$2x - 1 = 4$

$+1 \quad +1$

$\frac{2x}{2} = \frac{5}{2}$

AM S DEP

$x = \frac{5}{2} = \frac{20}{8}$

2.5

Notes 2/3 - Solving Equations for a Variable

Helpful Hints:

- Remember that when you divide by a fraction, you just multiply by the reciprocal

Ex: $\frac{A = \frac{1}{2} \cdot C}{\frac{1}{2} \quad \frac{1}{2}}$, solve for C

← dividing by $\frac{1}{2}$ is the same as multiplying by $\frac{2}{1}$

$\frac{2}{1} A = \frac{1}{1} C$ $\quad \boxed{2A = C}$

- To undo squaring (x^2), take the square root ($\sqrt{\ }$)

- If the variable you're solving for is in the bottom, multiply both sides by the variable first to move it to the top

Ex: $R \cdot V = \frac{I}{R} \cdot R$, solve for R

$\frac{RV}{V} = \frac{I}{V} \quad R = \frac{I}{V}$

- Really more like rearranging than solving

Ex:

2. $\frac{A}{\frac{1}{2}b} = \frac{\frac{1}{2}bh}{\frac{1}{2}b}$, solve for h

divide by $\frac{1}{2}$ is $\times 2$

$\boxed{\frac{2A}{b} = h}$

Ex: $\frac{4}{3d} B = \frac{43}{34} \frac{Cd}{d}$, solve for C

$\frac{4B}{3d} = C$

Notes 2.1c – Simplifying Radicals

$\sqrt[x]{}$

- Undo exponents

$\sqrt{x^2} = x$ · square root $\sqrt[3]{x^3} = x$ · cubed root $\sqrt[4]{x^4} = x$ · fourth root

- Perfect Squares

$1^2, 2^2, 3^2, 4^2, 5^2, 6^2, 7^2$

→ 1, 4, 9, 16, 25, 36, 49, 64, 81, 100

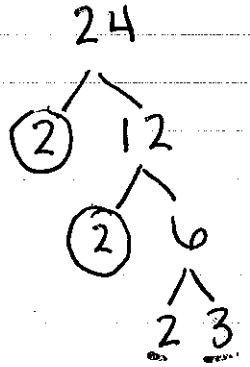
Ex: Simplify $\sqrt{24}$

Method 1
- find perfect squares hidden in 24 (factor of)

$24 = 6 \cdot 4$

$\sqrt{24} = \sqrt{6} \cdot \sqrt{4} = \boxed{2\sqrt{6}}$

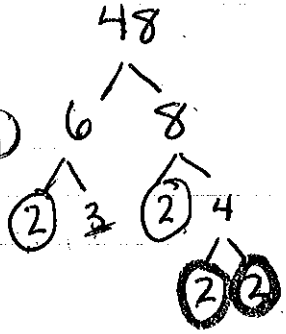
Method 2 - Factor tree



$\sqrt{24} = \sqrt{2^2 \cdot 2 \cdot 3}$

$2\sqrt{6}$

Ex 2: $\sqrt{48} = \sqrt{16 \cdot 3} = \sqrt{16}\sqrt{3} = \boxed{4\sqrt{3}}$



$\sqrt{48} = \sqrt{2^2 \cdot 2^2 \cdot 3} = 2 \cdot 2\sqrt{3}$

$\boxed{4\sqrt{3}}$

Simplifying Radicals Cont'd

Ex 3: $\sqrt{75}$

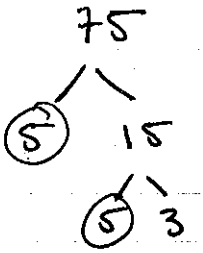
M1: Find a factor of 75 that is a perfect square

$75 = 25 \cdot 3$

$\sqrt{75} = \sqrt{25 \cdot 3} = \sqrt{25} \cdot \sqrt{3}$

$= \boxed{5\sqrt{3}}$

M2: Factor 75 and find all pairs



$\sqrt{75} = \sqrt{5^2 \cdot 3} = \sqrt{5^2} \cdot \sqrt{3} = \boxed{5\sqrt{3}}$

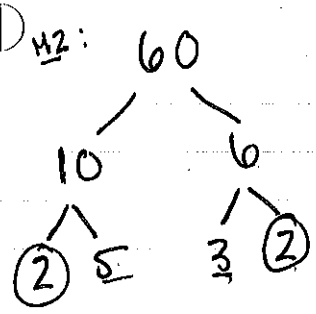
Ex 4: $\sqrt{60x^3}$

M1: Find a perfect square

$60 = 4 \cdot 15$

$\sqrt{60} = \sqrt{4 \cdot 15} = \sqrt{4} \cdot \sqrt{15} = 2\sqrt{15}$

M2:



$2\sqrt{3 \cdot 5}$

$2\sqrt{15}$

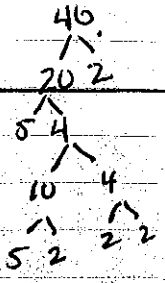
$\sqrt{x^3} = \sqrt{x^2 \cdot x} = \sqrt{x^2} \cdot \sqrt{x}$

$= x\sqrt{x}$

$\boxed{2x\sqrt{15x}}$

Warm-Up 2/8

1) $\sqrt{40} = \sqrt{4 \cdot 10} = \sqrt{4}\sqrt{10} = \boxed{2\sqrt{10}}$



2) $\sqrt{54c^3} = \sqrt{9 \cdot 6 \cdot c^2 \cdot c} = \boxed{3c\sqrt{6c}}$

3) $\sqrt{x^5} = \sqrt{x^2 \cdot x^2 \cdot x} = x \cdot x\sqrt{x} = \boxed{x^2\sqrt{x}}$

$(x^5)^{\frac{1}{2}}$ $(x^4)^{\frac{1}{2}}$